

# ABSTRACT

A class of  $n \times \ell$  nonlinear block codes, termed Go-CDMA codes are constructed using column-reduced and row-reduced Hadamard orthogonal matrices, termed Go-CDMA matrices.

Here  $n, \ell$  are positive integers:  $n$  chips of user data are transmitted in frames of size  $\ell \leq \alpha n$ ,

5 where  $\alpha$  is the frame expansion factor. The codes map  $n$ -vectors containing binary message data to binary or multi-level  $\ell$ -vectors for transmission, where  $\ell \geq n$ . The codes are invertible maps for the binary message data, and when there is no message data in some input vector elements, and noise added between the coding and decoding, there is some error correction. The coding uses integer arithmetic and integer *quantization* operations, preferably certain *sign* operations.

10 Go-CDMA codes may be implemented in CDMA communication systems to improve performance on many measures over conventional CDMA and TDMA systems. The coding and decoding may include scrambling and descrambling the Go-CDMA coded signal based on random codes.